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**United States Patent** [19]**Thorne, III et al.**[11] **Patent Number:** **5,805,165**[45] **Date of Patent:** **Sep. 8, 1998**[54] **METHOD OF SELECTING A DISPLAYED CONTROL ITEM**[75] Inventors: **Edwin Thorne, III**, Seattle; **Patrick Michael Volk**, Kirkland, both of Wash.[73] Assignee: **Microsoft Corporation**, Redmond, Wash.[21] Appl. No.: **521,963**[22] Filed: **Aug. 31, 1995**[51] Int. Cl.<sup>6</sup> ..... **G06F 15/00**[52] U.S. Cl. .... **345/348**[58] Field of Search ..... 395/333, 332,  
395/348; 345/333, 332, 348, 339, 347,  
349[56] **References Cited****U.S. PATENT DOCUMENTS**

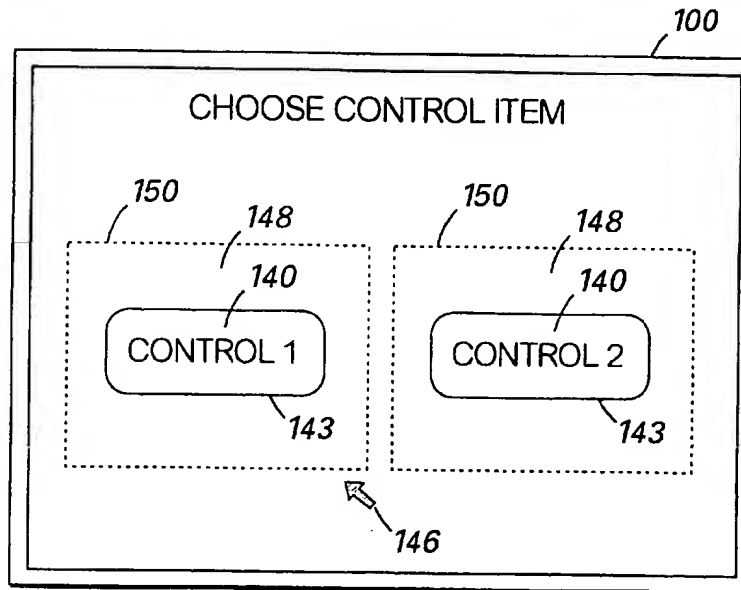
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[57]

**ABSTRACT**

A method that enables focus to be given to a displayed control item when a cursor is positioned within a predetermined activating area outside of the outer edges of the displayed control item. More particularly, the computer-implemented method for selecting a displayed control item on a display screen which includes the steps of: displaying a cursor on the display screen; displaying a control item on the display screen; providing an area extending around the control menu item; and providing focus to the control item when the cursor is positioned within the area extending around the control item. Preferably, the area extending around the control item is not visible on the display screen. With respect to the dimensions of the area extending around the control item, the dimensions preferably are (height  $H + \text{constant } C1$ ) by (length  $L + \text{constant } C2$ ), where  $H$  is the dimension defining the height of the control item and  $L$  is the dimension defining the length of the control item. If control items have overlapping activation zones, a weighting scheme is used to select the appropriate control item.

**22 Claims, 10 Drawing Sheets**

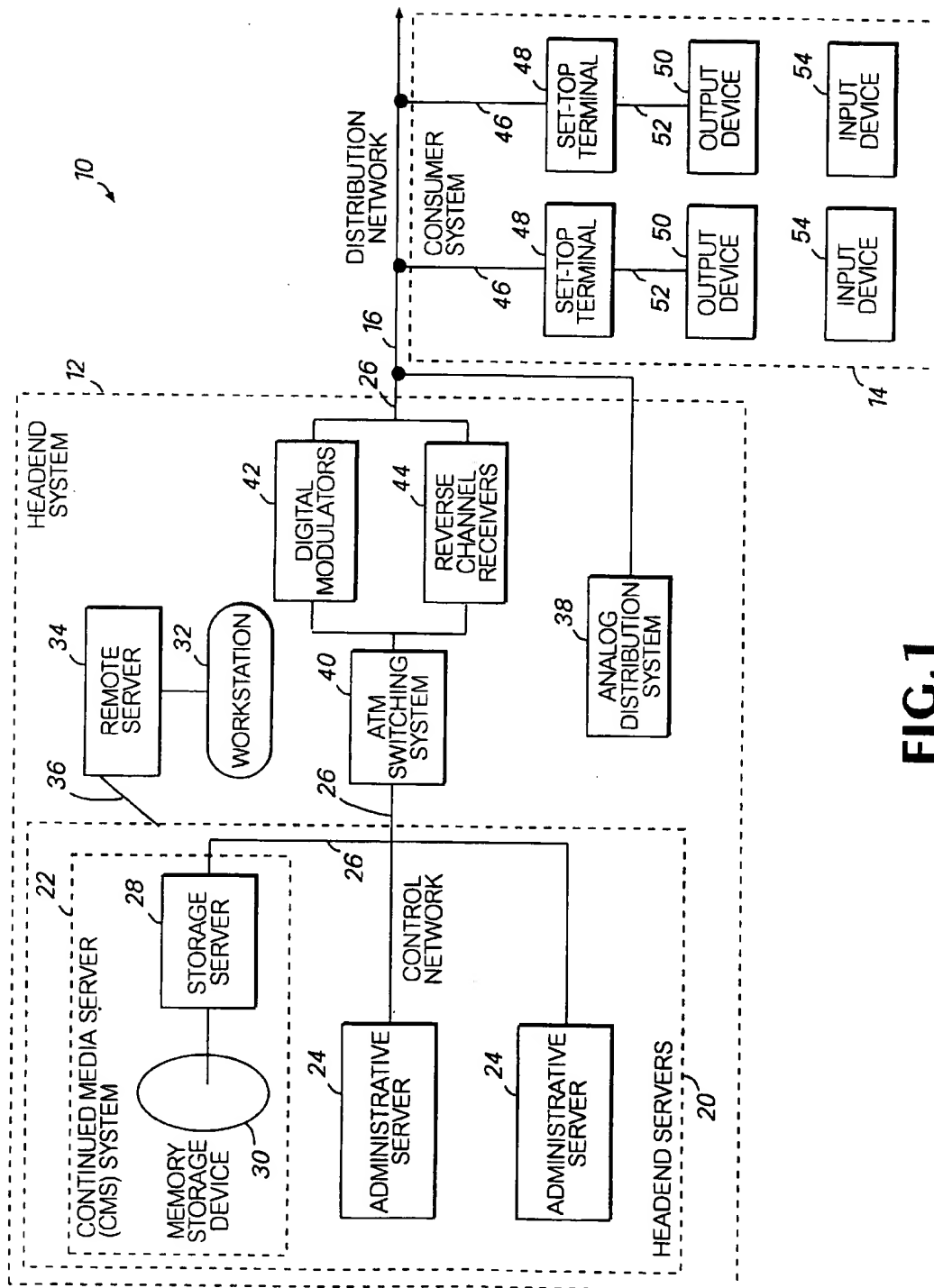
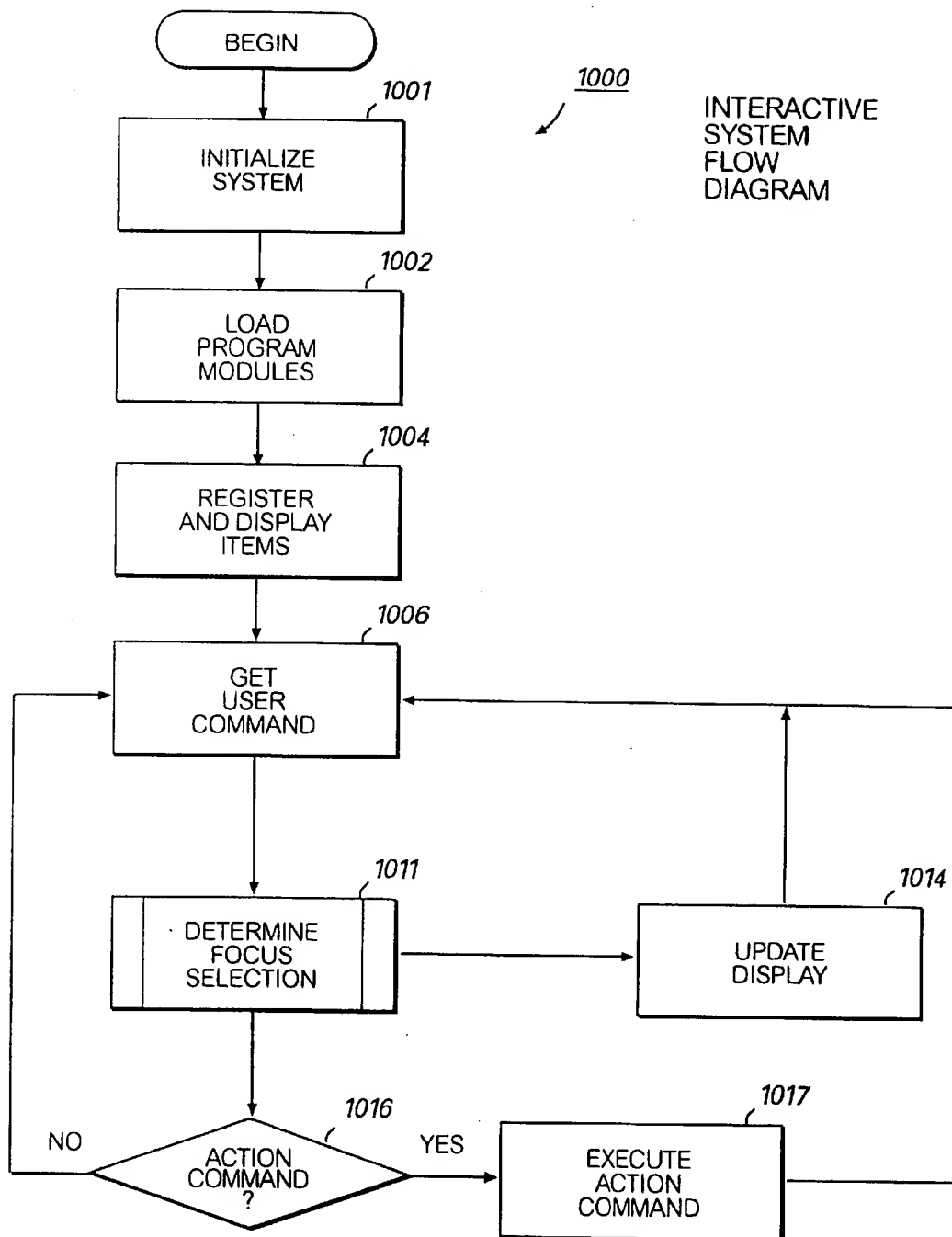


FIG. 1

**FIG.10**

actually presented to the viewer. However, it will be appreciated that this implementation also effectively reduces "usable screen space" or display resolution for the user interface.

Because in an interactive system the user will make selections based on controls or instructions provided on the television screen, the method of selection of these controls, with a handheld remote control device, should be user friendly. The method of selection should also be designed for the special concerns associated with displaying information on a television screen as compared with a conventional display screen used with personal computers. As in many computer-controlled displays, the positioning of a cursor provides the selection method for designating a desired control. The term "cursor" as used herein includes any form of movable marker, such as a pointer, blinking line, or the like. However, the control or movement of a cursor in an interactive television environment may not be as precise or sophisticated as can be achieved with a general pointing device, such as a mouse used with conventional personal computers. Thus, cursor control or positioning can be problematic in an interactive television environment. Also, due to space limitations, when numerous controls or objects are displayed on a screen, the controls may be close together or small in relation to the screen. In this case, positioning a cursor on a displayed control can be problematic, especially when the selection is being made from across the room by a viewer with less than perfect eyesight.

Thus, there is a need in the art for a user interface having simplified user interface controls that are optimized for the television environment in both appearance and behavior and for a method of improving selection of menu or control items presented on computer-controlled displays.

#### SUMMARY OF THE INVENTION

Generally described, the present invention provides a method that enables focus to be given to a displayed control item when a cursor is positioned within a predetermined activating area outside of the outer edges of the displayed control item.

More particularly, the computer-implemented method of the present invention for selecting a displayed control item includes the steps of: displaying a cursor on the display screen; displaying a control item on the display screen; providing an activating area extending around the control item; and providing focus to the control item when the cursor is positioned within the activating area extending around the control item. Preferably, the activating area extending around the control item is not visible on the display screen.

With respect to the dimensions of the activating area extending around the control item, the dimensions preferably are (height  $H + \text{constant } C3$ ) by (length  $L + \text{constant } C4$ ), where  $H$  is the dimension defining the height of the control item and  $L$  is the dimension defining the length of the control item, and  $C3$  and  $C4$  are positive constant values. Thus, the activating area is preferably greater than and encompasses the area of the control item. Also, the pointing device used to direct the cursor within the activating area is preferably a remote control device.

When focus is provided to a control item several options for displaying the cursor may be provided. In one display method, the position of the cursor is automatically moved to the edge of the control item when the cursor is positioned within the activating area extending around the control item. In a second display method, the cursor disappears from the

display screen when the cursor is positioned within the activating area extending around the control item (i.e., when the control item is activated to receive focus). In a third display method, the cursor remains visible and the position of the cursor remains at the position at which the user positioned the cursor within the activating area extending around the control item.

In addition to the control item discussed above, a second control item may be provided. The method of the present invention further includes displaying a second control item within a second activating area extending around the second control item. The second activating area is operable for providing focus to the second control item when the cursor is positioned within the second area. In this embodiment, the first and second activating areas extending around the control items may partially intersect, thereby forming an overlapping area. When the cursor is positioned within the overlapping area, the present invention calculates a first weighted value based on the location of the cursor with respect to the first control item and calculates a second weighted value based on the location of the cursor with respect to the second control item.

After calculating the weighted values, the present invention selects the first control item or the second control item for providing focus to either of the control items based on the first and second weighted values. Preferably, the first control item is selected when the first weighted value indicates that the cursor is positioned closer to the first control item than to the second control item, or the second control item is selected when the second weighted value indicates that the cursor is positioned closer to the second control item than to the first control item.

Thus, it is an object of the present invention to provide an enhanced method of selecting control items displayed on a display screen.

It is another object of the present invention to provide focus to a displayed control item when a cursor is positioned within an area extending around the control item.

It is another object of the present invention to provide a method of selecting one of a plurality of control items when a cursor is positioned within overlapping areas extending around the control items that are operative to provide focus to either of the control items.

It is another object of the present invention to provide multiple display options for displaying the cursor when focus has been provided to a control item.

These and other objects, features, and advantages of the present invention will become apparent from reading the following description in conjunction with the accompanying drawings.

#### BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 illustrates the operating environment for an interactive network system.

FIG. 2 illustrates the basic components of a set-top terminal.

FIG. 3 illustrates the preferred remote control unit, which is used to transmit commands to the set-top terminal.

FIG. 4 illustrates control items utilized in the present invention.

FIG. 5 illustrates a method of displaying a cursor in the present invention when focus is given to a control item.

FIG. 6 illustrates another method of displaying a cursor in the present invention when focus is given to a control item.

FIG. 7 illustrates another method of displaying a cursor in the present invention when focus is given to a control item.

components, such as a receiver and a monitor, or as a single component, such as a conventional television or a general purpose computer system.

Selected operating functions of the set-top terminal 48 can be controlled by an input device 54 capable of supplying input data to the set-top terminal 48. The input device 54 can be used to transmit command signals to the set-top terminal 48 and to input character-based data, such as text, for processing by the set-top terminal 48. For example, the input device 54 can be used to control the position of a display object presented by the output device or to enter text for conducting a service-related transaction supported by the interactive network 10. The input device 54 can be implemented as one or more devices for inputting data, including a handheld control, a keyboard, a mouse device, a game control, a joystick, a pen or stylus, a trackball, or a track pad.

For the preferred embodiment, the input device 54 is implemented as a handheld remote control capable of transmitting infrared signals carrying commands for controlling the operation of the set-top terminal 48. The remote control can include a directional keypad having distinct keys for allowing the user to control direction (up, down, left, right, and diagonal directions) and relative changes in volume or channel (increase or decrease), as well as absolute changes to channel value via a numeric key pad. The remote control and its functions are more fully described with respect to FIG. 3.

FIG. 2 illustrates the basic components of the set-top terminal 48. Turning now to FIGS. 1 and 2, the primary components for the set-top terminal 48 include a network receiver 56, a network transmitter 58, a remote control receiver 60, a central processing unit (CPU) 62, and memory 64. These components are connected by a system bus 70, which can carry control, address, and data signals. The network receiver 56 conducts tuning operations for receiving a selected channel of the interactive network 10 and decoding operations for decoding compressed digitized data supplied via the interactive network 10. For example, the set-top terminal 48 can include MPEG decoding capability for converting the compressed digitized data into standard National Television Standard Committee (NTSC) video signals for reception by a conventional television. The network transmitter 58 transmits requests for programming information and related instructions for processing by the headend system 12. The network receiver 56 and the network transmitter 58 can be connected to the distribution network 16 via the drop cable 30. The remote control receiver 60, which may generally be implemented as an infrared receiving device or other wireless device using radio frequency controls, can decode signals carrying the commands issued by the input device 54, such as a remote control 80.

The CPU 62, which is connected to the network receiver and transmitter 56 and 58, as well as to the remote control receiver 60, controls the operations of the set-top terminal 48 and supports the rendering of graphical images of the user interface. The CPU 62 is typically implemented by at least one microprocessor, such as the model 80486 or the "PENTIUM" microprocessor, manufactured by Intel Corporation, Santa Clara, Calif. The CPU 62 communicates, by means of control, address, and data signals, with the remaining components of the set-top terminal 48 through the system bus 70. The CPU 62 operates in conjunction with the operating system 66 to retrieve, process, store, and display data. It will be appreciated that the processing functions of the CPU 62 may be divided among two or more microprocessors to support the presentation of a graphics-intensive user inter-

face. For example, a microprocessor may be dedicated to control operations associated with the bi-directional communications with the headend system 12, whereas another microprocessor may be dedicated to the generation of graphics.

The memory 64, which is connected to the CPU 62, is useful for storing one or more program modules and data associated with set-top terminal operations. Program modules stored in the memory 64 can include an operating system 66 and one or more application programs 68. The memory 64 can be implemented as a combination of dynamic memory, such as random access memory (RAM), and static memory, such as read only memory (ROM).

The operating system 66 comprises a set of computer programs that control the internal functions of the set-top terminal and support the execution of other program modules, including application programs 68. The preferred operating system 66 supports a graphics-based presentation of program-related information, including control items that visually represent control functions of the operating system and other program modules. A control item is any visual image that can be manipulated by the user to perform an operation. The operating system 66 can receive and interpret input data supplied by the input device 54, as received by the remote control receiver 60. As will be described in more detail below, a user can "select" and "launch" control items by the use of the input device 54 in a manner similar to the computer arts.

For the preferred set-top terminal 48, the memory includes a ROM containing at least a portion of program module representing "boot code" 72 for initializing the operations of the set-top terminal 48. Upon power-up of the set-top terminal 48, the boot code 72 initiates a request for the headend system 12 to download certain program modules, including the operating system 66 and one or more application programs 68. The program modules can be stored within the memory 64 of the set-top terminal 48. This downloading process allows the headend system 12 to easily update the program modules used in set-top terminals 48 throughout the interactive network 10. For example, the application programs 68 may be maintained within the set-top terminal 48 only during actual use of the features of these programs; otherwise, these application programs are maintained at the headend system 12. Thus, it will be appreciated that the preferred set-top terminal 48 relies heavily upon data storage mechanisms located at the headend system 12 rather than within the set-top terminal 48 itself.

The set-top terminal 48 can be connected to a peripheral device via input/output (I/O) ports 74. The I/O ports 74 supports the connection of the system bus 70 to a connected peripheral device. For example, the output device 50 can be connected to the I/O ports 74 via a conductor 52. Likewise, an input device 54, such as a game control 90, can be connected to the I/O ports 74. In contrast to the remote control 80, which communicates with the remote control receiver 60 via a wireless communications link, other types of input devices 54 are typically connected to the I/O ports 74 via a cable. Nevertheless, those skilled in the art will appreciate that input devices 54 can communicate with the set-top terminal 48 by use of either wireless or wired communications links.

Generally, when a user first powers-up a set-top terminal 48, the set-top terminal 48 contacts the headend system 12 and requests the downloading of certain program modules, including the operating system 66. In response to loading

these program modules, the set-top terminal 48 enters a stand-by mode to limit power consumption and awaits a command signal initiated by a user pressing a key or button on an input device 54, such as a remote control 80. In this stand-by mode, the set-top terminal can communicate with the headend system and can respond to administrative requests transmitted by the headend system 12. In the event that a user tunes to an interactive channel (typically by pressing the appropriate function key of the remote control), the set-top terminal 48 changes modes and enters the active mode. In the active mode, the set-top terminal 48 communicates with the headend system 12 to process the instructions transmitted by the remote control. For example, the set-top terminal 48 responds to a command requesting programming information by forwarding this instruction to the headend system 12 via the drop cable 46 and the distribution network 16. The headend system 12 responds by retrieving selected programming information from the CMS system 22 and transmitting the selected programming information via the return path provided by the distribution network 16 and the drop cable 46. The set-top terminal then supplies this programming information in the proper format for presentation by the display.

FIG. 3 illustrates the preferred remote control unit 80, which is used to transmit commands to the set-top terminal 48. The remote control unit 80 includes a variety of keys that are common to remote control units for use with conventional television sets. These include power on/off 101, channel up 102, channel down 104, volume up 106, volume down 108, mute 110, and a 10 digit numeric keypad 112.

The preferred remote control unit also includes keys that are specifically related to preferred interactive system. A menu button 114 is used to open and close on-screen menus, such as a channel manager object. A directional control 116 is a rocker switch that is used to manipulate the channel manager and select specific items by moving a cursor up, down, left or right. An action button 118 is used to launch a selected function. A help key 120 is to initiate on-screen help. An "A" button 122 and "B" button 124 are used to select specific options that are provided in some contexts.

Having discussed the physical environment of the interactive system, the operations and methods of the present invention will be discussed. As noted above, to invoke or launch an option represented by a control or selection item presented on a display screen, the user positions a cursor on the desired item to be selected and actuates a selection mechanism, such as a control switch or action button, to choose the desired option or function represented by the control item. By actuating the selection mechanism, the user directs the computer program of the operating system to execute the desired option or function. However, as discussed above, television entertainment systems generally do not use a precise or sophisticated pointing device, such as those controlled by a mouse, for a directional control device. Instead, a directional control device 116 is frequently a joy stick or a simple four-directional control device. As a result, positioning the cursor on the desired option or control item can be a difficult process for a user. For example, it is not uncommon for the user to over-shoot or under-shoot the desired control item presented on the display screen.

The present invention provides a method that facilitates the selection of option or control items presented on a display screen. Referring to FIG. 4, the display screen 100 is shown displaying control items 140 labeled as control 1 and control 2. Control 1 and control 2 are defined on the display screen 100 by boundaries 143. It should be appreciated that any number of control items may be displayed on

the display screen 100 as screen space permits. As noted above, the positioning of a cursor, such as cursor 146, directly on a control item 140 may be difficult due to the distance between the user of the remote control 80 and the display screen 100. Also, positioning may be difficult due to the precision of maneuverability of the directional control device 116.

To enable selection of the displayed option or control items 140, the present invention provides control activation ("gravity") zones 148. The control activation zones 148 are defined by boundaries 150 that extend outwardly from the displayed control items 140. Preferably, the activation zones 148 are the same color and/or pattern as the surrounding background of the display screen 100, and thus are not generally visible on the display screen 100. The activation zones 148 are operable in helping to alleviate cursor maneuverability problems associated with some directional control devices, such as the difficulty of positioning the cursor directly on a displayed control item 140. Conventionally, a cursor must be directly placed on a displayed control item, within boundary 143, in order for the control to be highlighted or given focus. When a control is highlighted, this signals to a user that the depression and/or release of the selection mechanism will invoke the function provided by the control. However, in the preferred embodiment of the present invention, when a cursor comes in contact with or is guided within the boundaries 150 of the activation zone 148, the control is highlighted or given focus as illustrated in FIG. 5. As known to those skilled in the art, the cursor position on a display screen is tracked by a focus manager program of the operating system which enables the present invention to determine whether the cursor 146 is within an activation zone 148.

FIG. 5 shows a cursor 146 that has been positioned within the activation zone boundary 150 and thus has caused focus to be given to control 1. By providing the activation zone 148, focus may be given to the displayed control 1 although the user has not precisely placed the cursor 146 on the control. Thus, focus may be "picked up" in an extended activation area around a control rather than requiring direct placement within the boundaries that typically define a control in a conventional computer-controlled environment. This enables the user to indicate a selection without precision placement of a cursor from across a room to designate a small target. It should be appreciated that the size and dimensions of the activation zones 148 may vary to suite the particular application. Additionally, when many controls are placed on a display screen 100, providing a fully visible selection area around multiple controls may cause the display screen 100 to appear cluttered. However, in implementing the present invention, the twofold benefit of enabling less than precise placement of the cursor to indicate a selection and the benefit of providing a less cluttered display screen are provided because part of the activating focus area may not be visible.

In the embodiment of the present invention illustrated in FIG. 5, when the cursor 146 is guided to a position 146A that is slightly inside of the activation zone 148, focus is "pulled" to or gravitates to control 1, hence the activation zone 148 may also be referred to as a "gravity" zone 148. As shown, control 1 becomes highlighted when the cursor 146 is positioned in the activation zone 148. In the embodiment illustrated in FIG. 5, when the cursor 146 as shown in FIG. 4 is guided to position 146A, the cursor visibly moves to the location of the cursor 146 shown in FIG. 5, which is at the displayed location of the control 1. In this embodiment, the cursor 146 moves independent of user control when the user